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RESEARCH ARTICLE

CAUSALITY TEST OF ICT GROWTH AND ECONOMIC DEVELOPMENT IN HUMAN DEVELOPMENT INDEX PERSPECTIVE

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ABSTRACT

This paper applied Granger Causality test to examine the relationship between ICT (information and communication technology) and economic development with human development index (HDI) as a proxy for economic development. This is accomplished by using time-series data of ICT growth contribution to economy and HDI, which covered time period of 19 years (2000 - 2018).The causality test revealed a high level of causal relationship between the dependent and independent variables, and the time series data for the covered time period are stationary. The result of the causality test also revealed that all the three variables (number of internet users, number of mobile cellular telephone subscriptions, number of fixed telephone subscriptions) collectively do not Granger cause the dependent variable (human development index); also the dependent variable HDI does not Granger cause all the independent variables respectively. It is then concluded based on the achieved results that the proxies for ICT growth in this study can be utilized to predict future Human Development Index values as indicated by the granger causality of the first lap.

INTRODUCTION

Adoption of Information and Communication Technology (ICT) has shown to have great impact on HDI (Human Development Index). Past and recent Studies carried out suggest that innovation and technology are the main indicators of improved economic development in developed countries (14). According to a survey conducted by the International Telecommunication Union (5), Nigeria has a high population density and the mobile phone sector is considered the major sector that makes a number of job opportunities available in the country. Furthermore, in September, 2018, a survey conducted by the Nigerian Communication Commission (NCC) revealed that the contribution of the Telecoms Industry to GDP was rated 7.7% in 2012 as against 10.43% in the second quarter of 2018 (6). This shows the huge contribution of the telecoms industry to GDP resulting to economic growth and development. Furthermore, the Executive Vice Chairman of NCC, Prof Umar Dambatta of Nigeria revealed that the ICT sector contributed N500 billion to the Nigerian economy in 2014 and provided about 2.5 million employments in 10 years and generated $30 billion direct investment between 2003 to 2014 (13).

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ICT penetration is increasing and spreading, developing countries receiving hope through the expansion of ICT penetration to achieve technological advances that make contribution in advancing and developing their financial prudence (15). The uses of ICT can lead the nation to overall economic development. In spite of significant literatures that seeks to contribute to the growth, development and productivity impact of ICT adoption, the credible feedback from economic growth and development to ICT adoption has not been subjected to human development index perspective. The studies, which have made close effort focused on Gross Domestic Product Perspective. Therefore, this study aims to analyse the Causality Relationship Model of ICT Growth and Nigeria Economic Development in Human Development Index Perspective by using a time series data of 19 years (2000 – 2018).

LITERATURE REVIEW

According to (10) school of thought: The Technophilic and the Technophobic clarify the relationship between ICT and economy. Over the past years, ICT applications have established in a series of instances through the developing world that they can be potent tools to link the gaps of economic development (8). In several sectors of the economy, ICTs will inflate productivity, provide ease to the human development index as a prior measure of economic development i.e.

It is used to improve standard of living gross domestic product per capita (GDP per capita), used to enhance teaching and learning means and used to support health and fitness. (7), researched the economic growth obtained from the impact of telecommunications industry in Nigeria. The discoveries showed that number of telecom users have a weighty influence on the economic growth in Nigeria. (12) studied the effects of telecommunications adoption on economic growth in developing countries from 1990 to 2001 and revealed that there is a direct correlation between telephone penetration and economic growth. The landline and mobile phone adoption are evaluated together, an increment in the number of telephones per 100 inhabitants is associated with a significant increase on GDP by 1% for telephone penetration. Overall, growth in landline penetration accounted for an average GDP increase of 1.62% while the high growth rates of mobile phone penetration, contributed on average 2.48 percent to GDP in the examined countries. (9) investigated causality analysis between fixed investment shares and economic growth for the post-war era and proposed that differing to the prior results in the literature, causality analysed between the two different variables moves in both directions. The study results are dependable with the predictions of Solow-type growth model, but they contrast with the classical view that fixed capital investment is the key to the long-run economic growth (11). Furthermore, (10) examined information and communication technologies in Nigerian economy and the discoveries showed that 77% variation in Gross Domestic Product (GDP) during 1999 – 2004 is attributable to investment in telecommunication. He specified that investment in ICT lifts up the effectiveness of economic activities, and that economic growth arouses the call for telecommunications and other ICT's components.

In addition, in (3) investigation, causality relationship was analysed between telecommunications firms and real GDP in the United States for the period from 1947 to 1997. By utilizing a 50-year time series and adopting Granger-Sims causality analysis, the investigation finalised that investment by telecommunications firms is caused by (but does not cause) growth in Gross Domestic Product. Such unneglectable ideas seem somewhat uncertain as to how investments by these firms have contributed nothing to GDP growth through such a lengthy period of time. From the examined literatures, which shows the relationship between cooperative or industry-level investments and growth, none have focused specifically on the role of ICT on the economy. To fill this gap in the literatures, this study analysed the causal relationship between the rate of growth of GDP per capita, as proxy for economic growth, and the part of ICT resources expenditure by utilizing a group of 70 countries for the time period of 2003 to 2008. Likewise, (4) studied the causal relationship among the part of fixed venture in GDP and the rate of growth of actual GDP per capita for the group of seven major industrialized countries on an individual basis for the period of 1960 to 1995. The obtained results recommend that the causal relationship between the variables varies significantly across these nations by utilizing a time series VAR model. Explicitly, causality between the variables appears to have nation-specific nature which may run in any direction. From the above studies, which examined the impacts of ICT growth, none have focused on the relationship of ICT growth and economic development in Human Development Index perspective.

To fill in this gap in the literature, this study analyses the causality Relationship Model of ICT Growth and Nigeria Economic Development in Human Development Index Perspective for the period of 19 years (2000 – 2018).

METHODOLOGY

Often, causality tests are grounded on Granger (1969). Nevertheless, in a further vital way, Granger causality is not automatically equal to the idea of "causation". It is relatively close to the idea of "precedence". Granger causality is a concept of causality that is based on forecasting (1). It is based on whether or not previous values of a variable makes a difference to forecast another variable. It answers the questions; would variable x be valuablein predicting variable y? Granger causality between two variables cannot be deciphered as a genuine causal relationship but simplyshows that one variable can offer assistanceto create a more exactprediction of the other variable (2). In testing for Granger causality, variables are usually analysed in pairs to test their interaction. It has two-way causation for all the conceivablesets of variables. X Granger cause Y and Y Granger cause X.

SOURCES OF DATA AND DATA PRESENTATION

To perform a strong analysis and get good results, it is important to collect data from reliable sources. Therefore, in this study, secondary data was collected from the United Nations Development Programme (UNDP) and Nigerian Communications commission (NCC). UNDP works in nearly 170 nations and terrains, assisting to accomplish the eradication of poverty, and the decrease of disparities and rejection (UNDP, 2020) and this makes it a good place to fetch data. The data used for this research was sourced from the Nigerian Communications Commission and United Nations Development Programme Statistical data base from 2000 to 2018. The variables of interest were regressed using Statistical Package for Social Sciences (SPSS) version 21. Human Development Index (Y) was regressed with number of internet users (X_1), number of mobile cellular telephone subscriptions (X_2) and Number of fixed telephone subscriptions(X_3). The data are descriptively analysed using mean, standard deviation and charts. Mean describes the center of the distributed data. Standard deviation measures how spread-out the data are around the center (mean).

Table 1. Descriptive Statistics

	Mean	Std. Deviation	N
Human Development Index	.49121	.029856	19
log_NIU	7.0341	1.02385	19
log_NMCTS	7.4000	1.05306	19
log_NFTS	5.7437	.38391	19

Source: Result Output; SPSS V21

The descriptive statistics presented in table 1 shows the mean of the variables employed in this study for the period of nineteen years (2000 - 2018). The results indicate that the center value of Human Development Index is 0.49121, Log Number of Internet Users (log_NIU) is 7.03, Log Number of Mobile-Cellular Telephone Subscriptions (log_NMCTS) is 7.4 and Log Number of Fixed-Telephone Subscriptions (log_NFTS) is 5.74.

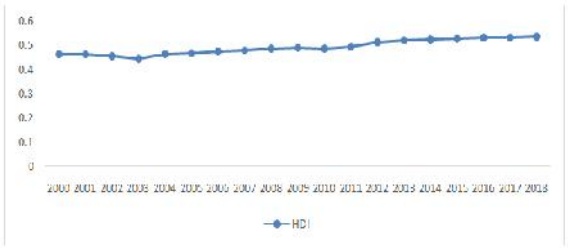

Figure 1. Variations in HDI in Nigeria from 2001 to 2018

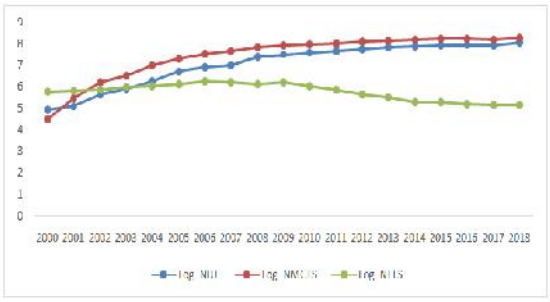

Figure 2. Variations in HDI in Nigeria from 2001 to 2018

Also, the analysis descriptively shows that the Human Development Index is 0.03 away from the center. Data of Log number of internet users is 1.03 away from the mean. Data of Log number of mobile-cellular telephone subscriptions and Log number of fixed-telephone subscriptions are 1.05 and 0.4 away from the mean respectively. A higher standard deviation indicates more spread out in the data around the mean while lower value indicates a narrow spread out of the data around the mean. The results showed that the data of all the variables have low standard deviation (0.03, 1.03, 1.05 and 0.4) which means that they are narrowly. Figure 1 and 2 shows the plot of Changes in HDI and proxies of ICT growth (number of internet users, number of mobile-cellular telephone subscriptions and number of fixed-telephone subscriptions) for eighteen years (2000 – 2018).

EMPIRICAL RESULTS

All time series is expected to be tested for the presence of unit roots in order to implement the Granger causality test. E-view was used to test if the data is stationary or not before using it in a regression.

Table 2. Stationarity Test

Null Hypothesis: Unit root (individual unit root process)				
Series: FIXED_ TELEPHONE, HDI, INTERNET_USERS, MOBILE_TELEPHONE				
Date: 14/08/20 Time: 21:19				
Sample: 2000 2018				
Exogenous variables: Individual effects				
Automatic selection of maximum lags				
Automatic lag length selection based on SIC: 0 to 2				
Total number of observations: 74				
Cross-sections included: 4				
Method		Statistic		Prob.**
ADF - Fisher Chi-square		49.3262		0.0003
ADF - Choi Z-stat		-1.90894		0.0007
** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.				
Intermediate ADF test results				
Series	Prob.	Lag	Max Lag	Obs
FIXED_ TELEPHONE	0.0639	2	2	13
HDI	0.1255	1	2	14
INTERNET_USERS	0.0123	0	2	15
MOBILE_ TELEPHONE	0.0002	2	2	13

Source: Results from e-views software student edition

Table 3. Granger Causality Test

Pairwise Granger Causality Tests			
Date: 14/08/20 Time: 21:19			
Sample: 2000 2018			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
Fixed_telephone does not granger cause hdi	14	6.21061	0.0314
Hdi does not granger cause fixed_telephone	1.23221	0.3321	
Internet_users does not granger cause hdi	14	1.43810	0.0011
Hdi does not granger cause internet_users	0.22350	0.2454	
Mobile_telephone does not granger cause hdi	14	9.23227	0.0026
Hdi does not granger cause mobile_telephone	2.80858	0.2139	
Internet_users does not granger cause fixed_telephone	14	5.23371	0.1311
Fixed_telephone does not granger cause internet_users	0.57395	0.5826	
Mobile_telephone does not granger cause fixed	14	1.01587	0.4001
Fixed_telephone does not granger cause mobile_telephone	1.05808	0.3866	
Mobile_telephone does not granger cause internet_users	14	1.23346	0.3362
Internet_users does not granger cause mobile_telephone	2.20853	0.1658	

Source: Results from e-views software student edition

A time series has stationarity if time shifts does not cause a change in the shape of the distribution. Unit roots are one cause for non-stationarity. The results of the analysis are shown in Table 2. The Augmented Dickey-Fuller (ADF) test which is known to handle bigger and more complex models examined each variable data and accepted or rejected the null hypothesis based on the decision rules of the evaluated P-value. There is unit root and the series is non-stationary and if P-value < 1, there is no unit root and the series is stationary. HDI, number of internet users, number of mobile-cellular telephone subscriptions and number of fixed-telephone subscriptions have P-values < 1 meaning that there is no unit root and that the series is stationary hence the alternate hypothesis is accepted.

GRANGER CAUSALITY TEST USING E-VIEW

The granger causality test is employed to determine causality between variables in a time series and also determined if the data has any forecasting properties. Patterns of correlation can be evident from results of this test. For this research causality between ICT proxies and HDI is sought. The results of the analysis are shown in Table 3. Results from table 4 indicates a granger causality between the number of fixed telephone subscriptions and HDI but the converse does not hold. At 0.05 level of significance, the hypothesis (H_0)that number of fixed-telephone subscriptions does not Granger-cause HDI is rejected because the p-value (0.0314) is less than 0.05 while the H_{02} that HDI does not Granger-cause number of fixed-telephone subscriptions is accepted because the p-value (0.3321) is greater than 0.05. Also the same granger cause is observed between number of Internet users and HDI. The Null hypothesis (Number of Internet users does not Granger-cause HDI) is rejected in favour of the alternate becauseits p-value (0.0011) is less than 0.05 threshold, but the second lag hypothesis (HDI does not Granger-cause number of internet users) with p-value 0.2454 is accepted since it is greater than the threshold, hence this hypothesis is accepted. This implies that a unidirectional causality exists between HDI and number of internet users while the converse does not hold. Also a unidirectional granger causality holds HDI and mobile cellular telephone subscriptions since its p-value is less than the threshold on the one hand, but higher on the other hand.

The H_0 of Number of mobile-cellular telephone subscriptions does not Granger-cause HDI is rejected because the p-value (0.0026) is less than 0.05 while the H_0 of HDI does not Granger-cause number of mobile-cellular telephone subscriptions is accepted because the p-value (0.2139) is greater than 0.05. Conclusively these proxies can be used to predict future HDI values as indicated by the granger causality of the first lap.

CONCLUSION

The main drive for this investigation was to help the understanding of the impact of ICT growth to economic development of Nigeria. Several studies were reviewed to establish the strength of this study by using a different approach. Granger causality analysis was applied to prove the Relationship Model of ICT Growth and Nigeria Economic Development in Human Development Index Perspective over the period of 19 years (2000 – 2018). The study reveals bi-directional causality for the selected independent variables combined. The result of the causality analysis showed that in null hypothesis. Between Internet Users and Fixed Telephone, Internet Users does not Granger Cause Fixed Telephone and Fixed Telephone does not Granger Cause Internet Users. Also between Mobile Telephone and Fixed Telephone, Mobile Telephone does not Granger Cause Fixed Telephone and Fixed Telephone does not Granger Cause Mobile Telephone. Inclusively, Between Mobile Telephone and Internet Users, Mobile Telephone does not Granger Cause Internet Users and Internet Users does not Granger Cause Mobile Telephone. The robustness of this result across the independent variables can be interpreted as an indication that a one-year time period is not long enough to allow causality to take hold. This paper, on one hand, suggests causality from relationship model of ICT growth to the development of Nigeria economy countries which is consistent with the findings of previous investigation. One reason for the contribution of ICT is that these economies benefit from the full return of internet services, telephone and mobile subscription services.

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